Many Voices Working for the Community

Oak Ridge Site Specific Advisory Board

April 15, 2010

Mr. John Eschenberg
Assistant Manager for Environmental Management
DOE-Oak Ridge Operations
P.O. Box 2001, EM-90
Oak Ridge, TN 37831

Dear Mr. Eschenberg:

Recommendation 187: Recommendation on a Phased Approach for Addressing Potential Off-Site Contamination in Melton Valley

At our April 14, 2010, meeting the Oak Ridge Site Specific Advisory Board approved the enclosed recommendation regarding a phased approach for addressing potential off-site contamination from the Melton Valley waste disposal area under the Clinch River onto private property on the west side of the river.

The first step is to develop a verifiable data set for groundwater chemistry. That would include repetitive sampling to address high pH issues, as well as analysis for trace amounts of radionuclides and other constituents that could be associated with disposal practices in Melton Valley. All possible existing wells, plus those under construction, must be included in the sampling strategy.

Additional details regarding this sampling are included in the enclosed recommendation.

We appreciate your consideration of this recommendation and look forward to receiving your response by July 14, 2010.

Sincerely,

Ron Murphree, Chair, PE, CPE
rm/rsg

Enclosure

cc/enc:

Dave Adler, DOE-ORO
Cate Brennan, DOE-HQ
Mike Farmer, Roane County Mayor
Pat Halsey, DOE-ORO
Connie Jones, EPA Region 4
Local Oversight Committee
Rex Lynch, Anderson County Mayor
Melissa Nielson, DOE-HQ
Oak Ridge City Manager
John Owsley, TDEC

Oak Ridge Site Specific Advisory Board
Recommendation 187
Recommendation on a Phased Approach for Addressing Potential Off-Site Contamination in Melton Valley

Background

Melton Valley on the Oak Ridge Reservation (ORR) has received a large amount of radioactive and chemical wastes since the late 1940s. Solid and liquid wastes have been put in shallow burial sites and liquid waste, mixed with cement, has been injected into geologic strata at a depth of 1000 ft., a process known as "hydrofracture." Some of the radioactive and chemical waste is known to be migrating toward the Clinch River in both surface water and groundwater. The Department of Energy (DOE) has taken significant steps to isolate the sources of shallow groundwater contamination by means of engineered barriers such as diversion trenches and impermeable caps, with notable success. For decades, surface drainage has been controlled by White Oak Dam to help limit the spread of contamination to the Clinch River. Recently a series of monitoring wells, known as the "picket wells," has been installed near the Clinch River to provide data on the spread of relatively shallow groundwater. Having observed very low levels of contamination and high pH in some of these wells (low levels of strontium-90 have been detected in one well, but the origin of the nuclide is uncertain), DOE is installing monitoring wells on the west side of the river on private property.

There is concern that some contamination may be associated with the hydrofracture process. From 1959 to 1984, 43 experimental and disposal injections were made into four deep (~1000 ft.) wells at two hydrofracture facilities in Melton Valley with the disposal of more than five million gallons of waste grout into underlying shale. It is known that saline groundwater at the injection depth has been significantly contaminated with radionuclides from the grout, but the vertical and horizontal extent of the contamination is unknown. Injection pressures resulted in uplift of a large volume of rock and, most likely, opening of the natural complex (but mostly systematic) fractures in the underlying strata, complicating our understanding of groundwater flow patterns and possibly opening new flow paths. Obtaining additional information from the 111 wells in the vicinity of hydrofracture is not possible now, because most of the wells have been plugged and abandoned to help prevent contaminant migration.

Previous sampling of groundwater in Melton Valley picket wells and on private property across the river has revealed some exceptionally high pH values (pH 11 or greater). Ketelle and Rightmire[1] have reviewed the groundwater hydrology and chemistry in Melton Valley to determine if the high pH values could have a natural origin.

They provided an ion exchange mechanism involving clay to achieve moderately high pH values (9-10), but not values reaching 11. Explanation of these high values cannot draw on known natural processes, and an anthropogenic reason must be suspected; one possible reason could relate to highly alkaline condition of the wastes injected at the hydrofracture facilities. While there may be other explanations, this is an issue that must be clarified. If the alkaline condition is a result of hydrofracture (or possible as seepage from the burial grounds), it demonstrates the potential migration of waste materials to shallower depths and may be associated with off-site contamination

(west of the Clinch River). One significant point must be made, however, is we do not yet have a verifiable and reliable chemical data set for the wells that have been sampled, in some cases only once; getting additional chemical data is critical and is a cost-effective first step to resolving the issues.

The Oak Ridge Site Specific Advisory Board (ORSSAB) has previously addressed this issue of possible waste migration associated with the hydrofracture operation (Recommendation 178, April 9, 2009). It was recommended that the FY 2011 budget include monies to allow investigation of the hydrofracture sites with regard to contamination leaving the sites. DOE's response (August 3, 2009) indicated that the priority would be to determine if contamination is exiting the burial grounds and being transferred to off-site locations. This is a laudable response, but it fails to address the possible migration from Melton Valley and the hydrofracture operations.

Discussion

The subsurface hydrology of Melton Valley is exceptionally complex due to the complex geology. An outcome of the Ketelle and Rightmire[1] review is that groundwater could be migrating off-site in the vicinity of the Clinch River. Routine approaches to monitoring and modeling groundwater, applicable in flat-lying porous media, are of little use in this terrain. Several activities can be envisioned to gain additional information on the Melton Valley problem and the potential for off-site contamination; some of these approaches are quite expensive and others involve considerable theoretical modeling, an action that may not yield useful information. Others, which we propose below, are not expensive and will yield a great deal of useful data at minimal cost.

Recommendation

The ORSSAB recommends a phased approach for addressing this potential off-site contamination problem. The first step, which is most cost-effective, is to develop a verifiable data set for groundwater chemistry, increasing our level of confidence with regard to the issue of off-site migration of contaminated groundwater. Such must include repetitive sampling to address the high pH issue, as well as analysis for trace amounts of radionuclides and other constituents that could be associated with disposal practices in Melton Valley. All possible existing wells, plus those under construction, must be included in the sampling strategy.

The recommended phasing would include:

1. additional sampling and chemical analysis of, but not limited to, radionuclides, trace elements, pH, specific gravity, salinity, electrical properties.
2. analysis of results and sufficient modeling to better understand ORR groundwater transport processes.
3. determine need for and number of wells that might be needed for future work and analysis of well types and costs associated with new deep flow monitoring

Only at the conclusion of these activities would any recommendation be made for planning of additional wells.

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[1]Ketelle, R. H., and C.T. Rightmire, C. T., 2009 unpublished report, Hydrogeologic Conceptual Model of Melton Valley Bedrock Groundwater, 40 p.